

Phytoremediation Basics (Protocols)

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Phytoremediation is the direct use of living plants for remediation of contaminated soil, sludges, sediments, and groundwater through contaminant removal, degradation, or containment. Growing plants on a contaminated site as a remediation method is an aesthetically pleasing, solar-energy driven, passive technique that can be used to clean up sites with shallow, low to moderate levels of contamination. This technique can be used along with or in some cases in place of mechanical cleanup methods. Phytoremediation can be used to clean up metals, pesticides, solvents, explosives, crude oil, polycyclic aromatic hydrocarbons, and landfill leachates.

Phytoremediation is divided into several sub-fields. The sub-fields may be called: phytostabilization, phytoextraction, rhizofiltration, phytodegradation, rhizodegradation, or phytovolatilization.

Because of its widespread, favorable reception by the public, the technical community, and the regulators, phytoremediation is being employed at numerous sites. It is probably easier to gain regulatory acceptance of phytoremediation as a new technology than it is for most other new technologies. Each new use of phytoremediation requires careful preparation of justification for presentation to regulatory bodies and the public.

There are few guidance documents for this new and complex technology.

The Air Force Center for Environmental Excellence, Technology Transfer Division (AFCEE/ERT) developed the “*Draft Protocol for Controlling Contaminated Groundwater by Phytostabilization.*” The protocol is available on the AFCEE web page at the following URL:

<http://www.afcee.brooks.af.mil/er/ert/erthome.htm>

For additional information, please contact AFCEE through Major Jeffrey Cornell, Chief, ERT, (210) 536-4331, AFCEE/ERT, 3207 North Road, Brooks AFB, TX 78235-5363

Websites	URL Address
Interstate Technology and Regulatory Cooperation (ITRC)	http://www.itrcweb.org/common/default.asp
Phytoremediation Bibliography	http://www.rtdf.org/public/phyto/phytobib/biba-b.html
Phytoremediation of Organics Action Team	http://www.rtdf.org/public/phyto/default.htm
Remediation Technologies Development Forum (RTDF)	http://www.rtdf.org/default.htm
Phytoremediation Resource Guide	http://www.clu-in.org/pub1.htm

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Books and Journal Papers:

Adriano, D. C., J. M. Bollag, W. T. Frankenberger, Jr., and R. C. Sims, (eds). 1999. *Bioremediation of Contaminated Soils*. Agronomy Monograph No. 37. Am. Soc. Of Agronomy, Madison, WI 53711.

Eberts, S. M., C. W. Schalk, J. Vose, and G. J. Harvey. 1999. *Hydrologic effects of cottonwood trees on a shallow aquifer containing trichloroethene*. Hydrologic Science and Technology, Special Issue, 4th USA/CIS Joint Conference.

Glass, D. J. 1998. *The 1998 United States Market for Phytoremediation*. D. Glass Associates, 124 Bird Street, Needham, MA 02192.

Jones, S. A., R. W. Lee, and E. L. Kuniansky. 1999. *Geochemical effects of cottonwood trees on a shallow aquifer containing trichloroethene*. Hydrologic Science and Technology, Special Issue, 4th USA/CIS Joint Conference.

Skipper, H. D., and R. F. Turco, (eds). 1995. *Bioremediation, science and applications*. SSSA Special Pub. No. 43, Soil Science Society of America, Madison, WI 53711.

U.S. Environmental Protection Agency. 1998. *Draft, Phytoremediation Handbook For Site Managers*. National Risk Management Research Laboratory, 26 W. Martin Luther King Drive, Cincinnati, OH 45268.

U.S. Environmental Protection Agency. 1999. *Phytoremediation Resource Guide*. Office of Solid Waste and Emergency Response, Technology Innovation Office, Washington, DC; EPA 542-B-99-003.

U.S. Environmental Protection Agency. 2000. *Introduction to Phytoremediation*. National Risk Management Research Laboratory, U.S. EPA, Cincinnati, OH 45268, EPA/600/R-99/107.